
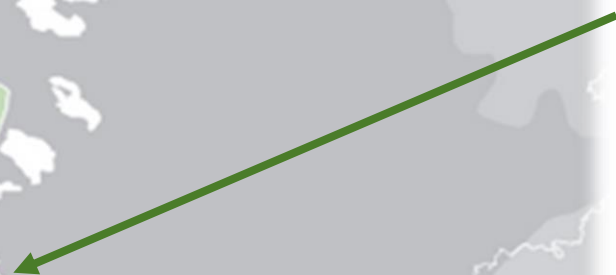

How the Absence of Higher PISA Scores is Connected to the Science Classroom?

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Latvia





Riga – Paris of the North

Introduction and background

- ❖ In 1998 development of the change of approach to the Science and Math curriculum was begun
- ❖ The implementation of complex reforms in Science and Math education in Latvia 2005-2011 (grades 7-12)
- ❖ The Center for Science and Math Education University of Latvia; from the end of 2011
- ❖ OECD PISA results show a gradual increase in students' performance in science subjects from 2006, but high level output is insufficient

Introduction and background

Table 1. Performance dynamics of Latvian students in PISA Science tests.

	2006	2009	2012
Student performance in science (main score)	490	494	502
Low performers (% of students below level 2)	17.4	14.7	12.4
Top performers (% of students at level 5 & 6)	4.1	3.1	4.4

Methodology and Research

- ❖ **Research question:** What do lesson observations reveal about the students' cognitive activity, the clarity of learning goals and feedback in science subject lessons?
- ❖ Lesson observations in real classroom setting and their analysis was used in this research to identify connection to PISA results
- ❖ In order to determine how several aspects of the curriculum reforms were implemented specified criteria were picked
- ❖ SOLO taxonomy was used to compare observed lesson outcomes

Methodology and Research

Table 2. Categories and chosen criteria.

Sequence in reforms		Specified criteria
Skills 2006	Competencies 2015	
Analytical and critical thinking skills	Analytical and critical thinking (Knowledge construction)	The level of cognitive demand
Learning skills	Self-directed learning	Learning goals Feedback

Methodology and Research

Table 3. Comparison of the levels of cognitive demand.

Level of cognitive demand	PISA level	National testing	Lesson observation	SOLO taxonomy
High	5, 6	High	3	Extended abstract; relational
Medium	3,4	Medium	2	Multi-structural
Low	1a, 2	Low	1	Non-structural
Under low	1b		0	Pre-structural

Methodology of Research

Following research methods were used fo data collection and analysis:

- ❖ Lesson observation and analysis by proffesionally trained experts
- ❖ Analysis of experts' feedback
- ❖ Analysis of curriculum documents, data of PISA research 2006-2012 and national testing



Lesson Observations

Methodology of Research

Collected data:

- ❖ In total 53 physics, chemistry, biology and science lessons in 9 different schools were observed and analysed
- ❖ 94% of science subject teachers from these schools were observed
- ❖ Schools represent all school types – primary, secondary and gymnasiums

Research results

- ❖ Research shows presence of higher order cognitive demand in 19% of observed lessons only

Table 5. Results according to the criteria selected (% of observed lessons).

Criteria/ Level	3	2	1	0
Level of cognitive demand	5	14	57	24
Presence and clarity of learning goals	25	25	35	15
Feedback	10	33	36	21

Research results

- ❖ Clarity of learning goals on acceptable level (2-3 scale) was observed in 50% of lessons
- ❖ Use of feedback was observed in 43% lessons, but mostly teachers failed to communicate feedback
- ❖ Experts comment to lesson transcript for an example:

“..the science class had a wonderful opportunity to focus on the essence of a solution as a concept and use previously mastered skills in a new situation in context. However, this opportunity was not used and problems were drilled by mechanically copying a set pattern.”

Discussion and conclusions

- ❖ Focus on low cognitive activity may be one of significant reasons why students fail higher levels of PISA tests
- ❖ Most of learning goals were of a low cognitive level and required memorizing and copying a set example

Discussion and conclusions

- ❖ Research shows that design and implementation of teaching strategies for developing HOCS challenge even the most expert teachers (Barak, Ben-Chaim, Zoller 2007)
- ❖ Possible cause for situation is that teachers are expected to teach skills that they themselves have never learned to teach
- ❖ There is a necessity for teachers' professional development to close the gap between the content of educational documents and a classroom practice

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